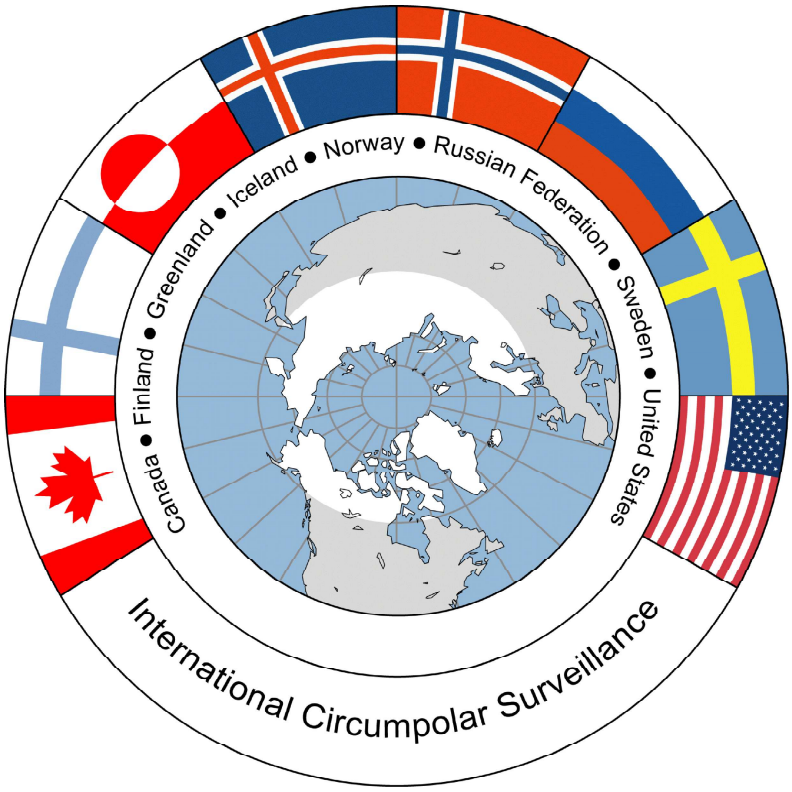
INTERNATIONAL CIRCUMPOLAR SURVEILLANCE (ICS) SUMMARY REPORT



YEAR 2000 DATA

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I. SUMMARY

International Circumpolar Surveillance (ICS), a population-based surveillance system for invasive bacterial diseases, has been established in the U.S. Arctic, Northern Canada, Greenland, Iceland, Norway and Finland. Data collection began in 1999 and includes the organisms *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Neisseria meningitidis*, and Groups A and B *Streptococcus*. This report reviews the data collected for the year 2000.

Data on invasive disease with the organism *Streptococcus pneumoniae* are collected from all participating countries; data on invasive disease with the remaining organisms are currently collected by the U.S. Arctic and Northern Canada. A total of 1,660 cases of invasive pneumococcal disease were identified in 2000. Overall, invasive *S. pneumoniae* was reported more often in males and in individuals 2-64 years of age. Case fatality rates ranged from 0-10%. Race and ethnic data are collected only in the U.S. Arctic and Northern Canada; rates of invasive pneumococcal disease in Northern Canadian Aboriginals and U.S. Arctic Native populations were 40 and 55 cases per 100,000 population respectively and were higher than rates in non-Aboriginals and non-Natives. Pneumonia and septicemia were the most common clinical presentations; cigarette smoking was the most common risk factor. Vaccine status was reported from three countries: Canada, Norway and the U.S. Arctic and ranged from 1% - 16% of reported cases vaccinated. In all countries, the most common *S. pneumoniae* serotypes were 4, 7F, 9V, and 14. The most common *S. pneumoniae* serotype in Northern Canada was serotype 1.

Data on invasive disease with *Haemophilus influenzae*, *Neisseria meningitidis*, and Groups A and B *Streptococcus* are currently collected in Northern Canada and the U.S. Arctic. A total of 24 *H. influenzae* cases, 10 *N. meningitidis* cases, 25 Group A *Strep* cases and 22 Group B *Strep* cases were collected in 2000. The highest case fatality rates were 25% for invasive *H. influenzae* cases reported in the U.S. Arctic and 29% for invasive Group A *Strep* cases reported in Northern Canada. Although the number of cases reported is small, 100% of Northern Canadian and 63% of U.S. Arctic cases of *H. influenzae* occurred in Aboriginal and Native peoples, respectively.

II. INTRODUCTION

In January 1999, the United States and Canada began an international cooperative initiative of population-based surveillance for invasive *Streptococcus pneumoniae* by all laboratories serving residents of the North American Arctic. In January 2000, this surveillance system expanded to include invasive diseases with the following organisms: *Haemophilus influenzae* (all types), *Neisseria meningitidis,* Group A *Streptococcus* and Group B *Streptococcus*. These pathogens were selected for ICS because rates of these diseases are elevated in indigenous peoples of the north, strains of these pathogens are rapidly acquiring resistance to commonly used antibiotics, these pathogens are routinely cultured in clinical laboratories, and clinically important serotypes of *Streptococcus pneumoniae*, *Haemophilus influenzae,* and *Neisseria meningitidis* are vaccine preventable in infants and adults.

Denmark's autonomous region of Greenland joined ICS in 2000, and Iceland, Norway (including

Svalbard), and Finland joined in 2001. To date, year 2000 data has been submitted by the U.S. Arctic (Alaska), Northern Canada, Greenland, Iceland, Norway and Finland. This report contains year 2000 data on all 5 surveillance organisms from Alaska and Northern Canada, and *Streptococcus pneumoniae* data from Greenland, Iceland, Norway and Finland. It is anticipated that ICS will include all circumpolar Arctic nations in a population-based surveillance system for invasive bacterial diseases in the near future.

III. GOALS

The goal of ICS is to establish an integrated network of hospital and public health facilities throughout the Arctic countries to monitor infectious diseases of concern. Linking public health facilities within the Arctic states will allow for the collection and sharing of uniform laboratory and epidemiological data that will describe the prevalence of infectious diseases in Arctic populations and assist in the formulation of prevention and control strategies.

The project, initiated in 1998, focused on establishing an ICS system for diseases caused by *Streptococcus pneumoniae*. This bacterium causes pneumonia, meningitis and bacteremia in both the very young and the elderly. Once easily treated with antibiotics, this bacterium is now becoming resistant to commonly used antibiotics. This is of great concern to the public health community and is increasingly a target for surveillance by many countries worldwide. A polysaccharide vaccine is available for use in persons 2 years of age and older. In the U.S. Arctic, this vaccine is recommended for all those over 55 years of age. A new conjugate vaccine for infants has been developed and is licenced for use in the U.S., Canada, and the European Union. The fact that diseases caused by *Streptococcus pneumoniae* are already being monitored by many public health authorities within the Arctic states make establishing a circumpolar surveillance system for this infection feasible. In addition, due to the availability of polysaccharide and conjugate vaccines, much of the morbidity and mortality caused by *Streptococcus pneumoniae* is currently preventable.

Key objectives of ICS include:

- Identifying key public health contacts within Arctic countries. These persons should be familiar with infectious disease surveillance systems in place (particularly surveillance systems for diseases caused by *Streptococcus pneumoniae*) in the member country. Through correspondence and working group meetings, the scope and gaps of the surveillance systems will be determined.

- Determining the comparability of laboratory and data collection methods, and negotiating standard protocols and quality control programs.

- Sharing and reporting data in agreed formats.

- The formation of a working group of key laboratory and public health contacts to coordinate pneumococcal surveillance within their respective jurisdictions. This group will meet on an

annual basis to review problems, progress, compliance, report generation, and future plans.

- The formation of a steering committee of national Arctic health experts to coordinate new objectives and initiatives within ICS.

Once established, this program will form a framework through which surveillance of other infectious diseases as well as prevention and control programs can be added. Other infectious diseases of circumpolar community concern include: other invasive bacterial diseases (caused by *Haemophilus influenzae*, *Neisseria meningitidis*, Groups A and B *Streptococcus*), tuberculosis, HIV, hepatitis, food (botulism, brucellosis), waterborne diseases, respiratory diseases of children such as those caused by respiratory syncytial virus, and chronic conditions related to infectious agents (hepatitis B virus and liver cancer, human papilloma virus and cervical cancer). In addition, the surveillance model developed by this program for infectious disease may be adapted to monitor other non-infectious human health priorities of community concern.

IV. METHODS

U.S. Arctic (Alaska) (AK)

- State-wide population-based surveillance
  - since 1980 for invasive Hi
  - since 1986 for invasive Sp
  - since 1999 for invasive diseases caused by Nm, Group A and B streptococci coordinated by the Arctic Investigations Program (AIP), National Center for Infectious Diseases, Centers for Disease Control and Prevention, in Anchorage, Alaska.

- All 25 laboratories providing diagnostic services to residents of Alaska submit to AIP isolates of Sp, Hi, Nm, GAS, and GBS cultured in blood, cerebrospinal fluid (CSF), or from other sterile sites.
  - Sp and Hi isolates are serotyped by the Quellung method using Statens Serum Institute antisera.
  - Serogroup testing of Nm isolates from Alaska is performed at the Canadian National Centre for Meningococcal Disease in their CNS Infections laboratory in Winnipeg.
    - by the slide agglutination method using specific antisera
    - by PCR detection of the siaDgene responsible for synthesis of the serogroup-specific polysialytransferase.

- Antimicrobial susceptibility testing of Sp isolates is performed at AIP by micro-broth dilution. (according to NCCLS recommendations).

- Clinical and demographic information on each case-patient is recorded by AIP research nurses using a standardized collection tool, the Bacterial Diseases Surveillance Form (BDSF).

Northern Canada (N CAN)

- As of January 2000, 14 Canadian laboratories participate in ICS.

- provide diagnostic microbiology services for all residents of the Yukon Territory, Northwest territories, Nunavut, Northern Quebec, and Northern Labrador
- submit all invasive isolates of Sp, Hi, Nm, GAS, and GBS to one of three reference laboratories in Canada.
- Sp, Hi, GAS, and GBS isolates are serotyped by the Quellung method using Statens Serum Institute antisera.

- Antimicrobial susceptibility testing of Sp, GAS, and GBS isolates were tested by micro-broth dilution (according to NCCLS recommendations).
- Communicable disease consultants located within one of the 5 regions of Northern Canada provided clinical and demographic information on the same collection form (BDSF) being used in the U.S. Arctic (Alaska).
- Laboratory and clinical data are forwarded to the ICS coordinator at AIP in Anchorage.

Greenland (GN)

- As of June 2000, 15 district hospital laboratories participate in ICS.
  - provide diagnostic microbiology services for all residents of Greenland
  - all invasive isolates of Sp submitted to reference hospitals in Nuuk and Copenhagen.
- Antimicrobial susceptibility testing of Sp isolates was performed by agar dilution at the Central laboratory at Queen Ingrid´s Hospital in Nuuk.
- Serotyping was performed at the Statens Serum Institute in Copenhagen, Denmark by the Quellung method.
- Clinical and demographic data for every case of invasive Sp was collected by public health authorities at the end of the year and entered onto the same collection form (BDSF) being used in the U.S. Arctic (Alaska) and Northern Canada.

Iceland (IC)

- As of June 2000, 10 district hospital laboratories participate in ICS.
  - provide diagnostic microbiology services for all residents of Iceland
  - all invasive isolates of Sp submitted to the reference hospital in Reykjavik.
- Antimicrobial susceptibility testing of Sp isolates is performed by disc diffusion method at the Landspitali University Hospital (LUH) in Reykjavik and the laboratory at the Regional hospital in Akureyri. All oxacillin resistant isolates are then analyzed by E test.
- Serotyping is performed at the LUH by co-agglutination.
- Clinical and demographic data for every case of invasive Sp was collected by public health authorities at the end of the year and entered onto the same collection form (BDSF) being used in the U.S. Arctic (Alaska), Northern Canada and Greenland.

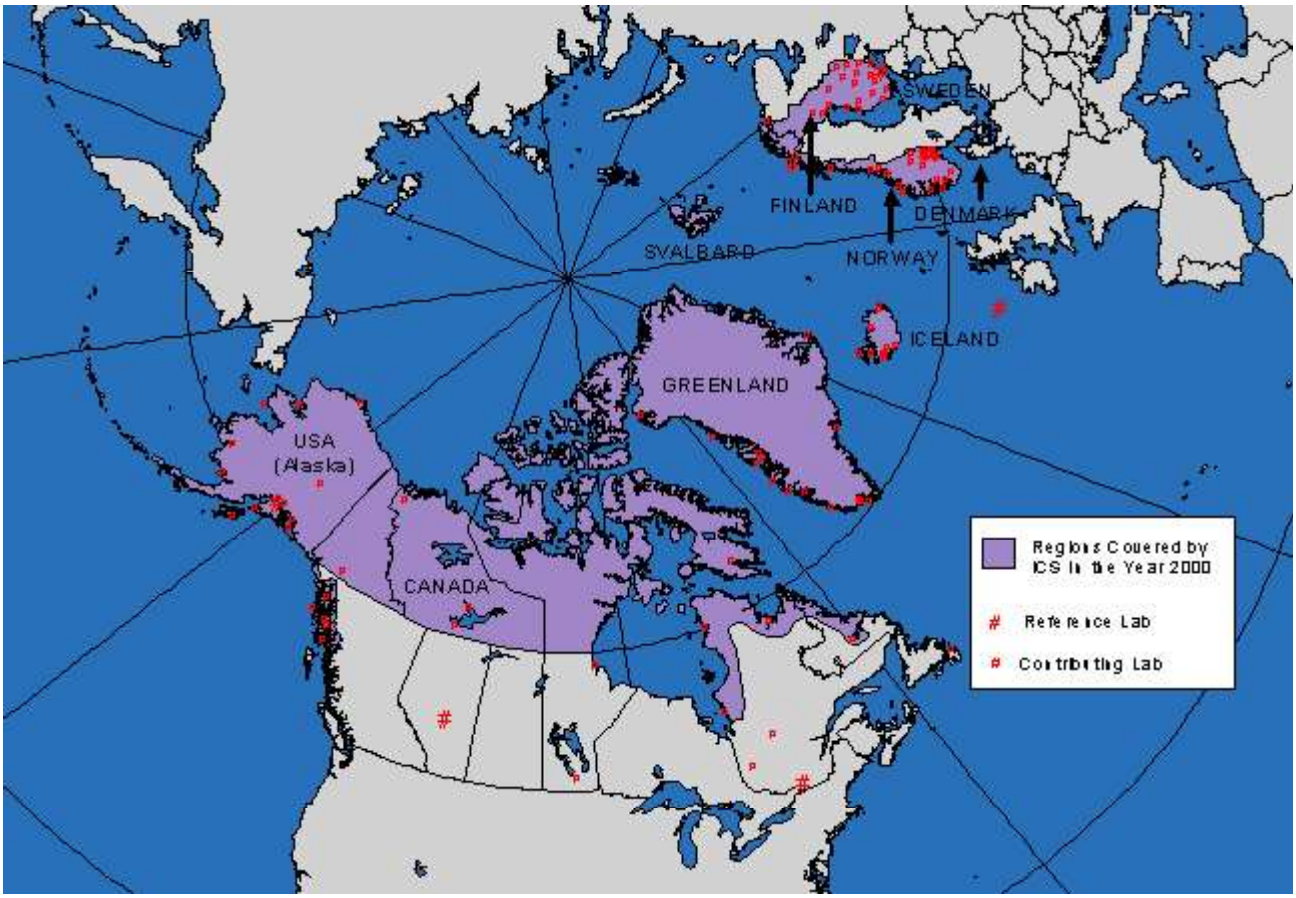
Norway (NOR)

- 33 district hospital laboratories participate in ICS.
  - provide diagnostic microbiology services for all residents of Norway
  - all invasive isolates of Sp submitted to one of two reference laboratories in Oslo or Tromso.
- Antimicrobial susceptibility testing of Sp isolates is performed using the disc diffusion method at district hospital laboratories, the reference laboratory in Tromso or the main national laboratory in Oslo.
- Serotyping is performed at the Statens Serum Institute in Denmark by the Quellung method.

Finland (FIN)

- 23 district hospital laboratories participate in ICS.
  - provide diagnostic microbiology services for all residents of Finland
  - all invasive isolates of Sp submitted to the National Public Health Institute (KTL) laboratory in Oulu.
- Antimicrobial susceptibility testing of Sp isolates was performed by the agar dilution method at district hospital laboratories as well as the KTL laboratory
- Serotyping is performed at the KTL laboratory by counter-immuno-electrophoresis

Figure 1: Laboratories in the U.S. Arctic (Alaska), Northern Canada, Iceland, Greenland, Norway and Finland, countries that have submitted data from the year 2000.



V. RESULTS

A. Cases and Rates by Country

In the year 2000, hospital, regional or central laboratories in Northern Canada, the U.S. Arctic (Alaska), Greenland, Iceland, Norway and Finland reported 1,660 Sp isolates from blood, CSF, or other sterile sites into ICS. Hospital, regional or central laboratories in Northern Canada and the U.S. Arctic (Alaska) reported to ICS 15 Hi isolates, 10 Nm isolates, 25 GAS isolates and 22 GBS isolates identified in blood, CSF, or other sterile sites. In the U.S. Arctic (Alaska) and Northern Canada, demographic and clinical information on all 5 invasive bacteria was collected prospectively, while in Greenland, Iceland, Norway and Finland summary data for Sp was collected in aggregate at the end of the year.

Table 1: Number of invasive isolates of Sp, Hi, Nm, GAS & GBS by country, ICS 2000 data

Country	Population	Sp # (rate)*	Hi‡	Hib	Nm	GAS	GBS	Total
N. Canada	133,375	45 (34)	8 (6)	0	1 (1)	7 (5)	4 (3)	**65 (49)**
U.S. Arctic	626,932	125 (20)	7 (3)	9 (1)	9 (1)	18 (3)	18 (3)	**186 (30)**
Greenland†	56,124	3 (5)	Not applicable					**3**
Iceland†	279,049	29 (10)						**29**
Norway†	4,478,497	857 (19)						**857**
Finland†	5,181,115	601 (12)						**601**
Total	10,754,760	1,660 (15)	15	9	10	25	22	**1,741**

*Rate per 100,000 population/year
‡Non-b serotypes
†Greenland, Iceland, Norway and Finland submitted only Sp data

The total number of cases of each bacterium with rates per 100,000 population/year appear in Table 1. Overall, Sp rates were lowest in Greenland (5), and highest in Northern Canada (34) with an overall rate for the current circumpolar region (including N. Canada, U.S. Arctic (Alaska), Greenland, Iceland, Norway and Finland) of 15 per 100,000. This overall regional rate is consistent with overall rates in the U.S. (*Active Bacterial Core Surveillance* data), Canada and Europe (*European Antimicrobial Resistance Surveillance System* 2000 data).

Because the total number of reported cases of invasive disease with Hi, Nm, GAS and GBS are small, rates generated for Northern Canada and Alaska are unstable and should be regarded only as an indication of relative differences. These rates will stabilize as more data is accumulated over the coming years.

B. Age & Gender Breakdown by Country

Table 2: Age and gender characteristics of case-patients by invasive organism, ICS 2000 data

	N CAN					AK					GN	IC	NOR	FIN
	Sp	Hi*	Nm	GAS	GBS	Sp	Hi	Nm	GAS	GBS	Sp	Sp	Sp	Sp
# Male (%)	29 (64)	5 (63)	0	4 (57)	2 (50)	68 (54)	5 (31)	7 (78)	10 (56)	12 (67)	3 (100)	9 (31)	404 (47)	359 (60)
Median Age (yrs) ♂&♀	31	4	<1	4	36	31	28	13	35	40	15	48	65	53
Age Range (years)	<1-72	<1-93	1 case	<1-63	0-59	<1-98	<1-80	1-65	<1-78	<1-86	8-33	<1-91	<1-97	<1-97
# < 2 yrs (column %)	11 (24)	2 (25)	1 (100)	3 (43)	1 (25)	36 (29)	7 (44)	1 (11)	1 (6)	6 (33)	0	3 (10)	38 (4)	60 (10)
# 2-64 yrs (column %)	32 (71)	4 (50)	0	4 (57)	3 (75)	69 (55)	7 (44)	8 (89)	15 (83)	8 (44)	3 (100)	17 (59)	391 (46)	349 (58)
# ≥ 65 yrs (column %)	2 (5)	1 (12)	0	0	0	20 (16)	2 (12)	0	2 (11)	4 (22)	0	9 (31)	430 (50)	192 (32)
Total	**45**	**8**	**1**	**7**	**4**	**125**	**16**	**9**	**18**	**18**	**3**	**29**	**857**	**601**

*One case missing age data.

Age and gender breakdown of cases by country are shown in Table 2. Overall, invasive pneumococcal disease was reported in males slightly more often than in females. Median age differed from country to country with the lowest median age reported from the U.S. Arctic (Alaska) & Greenland (15 years) and the highest median age of invasive pneumococcal disease from Norway (65 years). In all countries, the majority of pneumococcal disease cases occurred in persons age 2-64 years with the exception of Norway where the greatest proportion of cases occurred in persons ≥ 65 years of age.

Table 3: Rates (per 100,000 persons/year) of invasive diseases by organism in specified age groups, ICS 2000 data from Northern Canada

Northern Canada	Population	Sp	Hi	Nm	GAS	GBS
All Ages	133,375	34	6	1	5	3
Children < 2 yrs	5,808	189	52	17	52	17
Persons 2-64 years	122,862	26	3	0	3	2
Persons ≥ 65 yrs	4,705	43	1	0	0	0

Statistics Canada website: www.statcan.ca

Table 4: Rates (per 100,000 persons/year) of invasive diseases by organism in specified age groups, ICS 2000 data from the U.S. Arctic (Alaska)

Alaska	Population	Sp	Hi	Nm	GAS	GBS
All Ages	626,932	20	3	1	3	3
Children < 2 yrs	18,630	193	38	5	5	32
Persons 2-64 years	572,603	12	1	1	3	1
Persons ≥ 65 yrs	35,699	56	2	0	6	11

State of Alaska Website http://www.labor.state.ak.us/research/cgin/2kh02/ak.pdf.

Table 5: Rates (per 100,000 persons/year) of invasive diseases by organism in specified age groups, ICS 2000 data from Greenland

Greenland	Population	Sp
All Ages	56,124	3
Children < 2 yrs	2,238	0
Persons 2-64 years	51,369	6
Persons ≥ 65 yrs	2,517	0

Statistics Greenland website: http://www.statgreen.gl/english/

Table 6: Rates (per 100,000 persons/year) of invasive diseases by organism in specified age groups, ICS 2000 data from Iceland

Iceland	Population	Sp
All Ages	278,717	29
Children < 2 yrs	8,424	36
Persons 2-64 years	238,317	7
Persons ≥ 65 yrs	32,308	28

Statistics Iceland website: www.statice.is/welcome.html

Table 7: Rates (per 100,000 persons/year) of invasive diseases by organism in specified age groups, ICS 2000 data from Norway

Norway	Population	Sp
All Ages	4,478,497	19
Children < 2 yrs	144,983*	26
Persons 2-64 years	3,598,373*	11
Persons ≥ 65 yrs	684,323*	63

*Estimates calculated from age-grouped population data obtained at
Statistics Norway Website: http://www.ssb.no/english/yearbook/emne02.html

Table 8: Rates (per 100,000 persons/year) of invasive diseases by organism in specified age groups, ICS 2000 data from Finland

Finland	Population	Sp
All Ages	5,181,115	12
Children < 2 yrs	116,510*	52
Persons 2-64 years	4,285,407	8
Persons ≥ 65 yrs	777,198	25

*Estimates calculated from age-grouped population data obtained at Statistics Finland website: www.stat.fi/tk/tp/tasku/taskue_vaesto.html

Tables 3-8 show rates of disease in each member country stratified by age group. The highest rates of pneumococcal disease in most member countries (with the exception of Greenland and Norway) occur in children < 2 years of age. Annual rates (per 100,000 persons) in this age group were highest in the North American circumpolar region: U.S. Arctic (Alaska) (193) & Northern Canada (189) and lower in the European region: Iceland (36), Norway (26) & Finland (52). Greenland's rates are unstable due to small numbers; however, in Norway where routine vaccination of persons older than 65 years is recommended, the highest rate of pneumococcal disease (63) occurred in persons ≥ 65 years of age.

Because of small numbers, rates of invasive disease with Hi, Nm, GAS and GBS in Northern Canada and the U.S. Arctic (Alaska) may be difficult to interpret, but the overall trend shows children < 2 years of age to have the highest rates of invasive disease with all 4 organisms.

C. Number of Deaths & Case-fatality Rate by Country

Table 9: Number of deaths and case-fatality rate of ICS case-patients by invasive organism, 2000

	N CAN					AK					GN	IC	NOR	FIN
	Sp	Hi	Nm	GAS	GBS	Sp	Hi	Nm	GAS	GBS	Sp	Sp	Sp	Sp
# Deaths (Case-fatality rate)	0	0	0	2 (29)	0	13 (10)	4* (25)	0	1 (6)	2 (11)	0	1 (3)	70 (8)	NA

* Serogroup information available on 3 of the 4 isolates: 2 non-groupable, 1 serogroup B

Case-fatality rates for pneumococcal disease vary by country ranging from 0-10 (Table 9). Overall case-fatality rate for invasive Hi disease was high in Alaska (25). Case-fatality rates for invasive GAS in Northern Canada were also elevated (29).

D. Seasonality

Figures 2-3 are bar graphs of cases (y axis) by month of diagnosis (x axis). There was no distinct seasonality of invasive pneumococcal disease cases reported to ICS in 2000. Seasonality is difficult to

interpret for the other 4 organisms (Hi, Nm, GAS and GBS) due to low numbers.

Figure 2: Invasive *Streptococcus pneumoniae* Cases in N Canada, Alaska, Greenland & Iceland by Month of Diagnosis (ICS 2000)

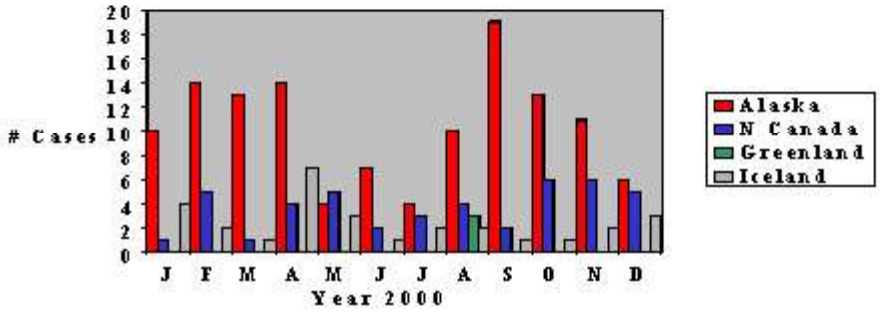
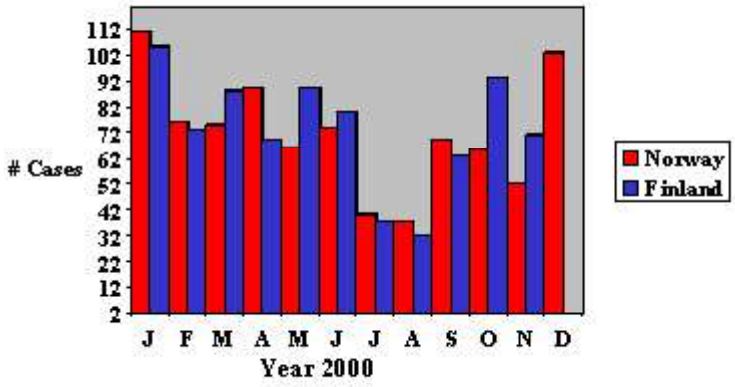


Figure 3: Invasive *Streptococcus pneumoniae* Cases in Norway & Finland by Month of Diagnosis (ICS 2000)



E. Race

The U.S. Arctic (Alaska) and Northern Canada provide race data on cases of invasive disease occurring with all 5 organisms. The U.S. Arctic (Alaska) provides data for the following groups: Eskimo, American Indian, Aleut, mixed race, non-Native, and unknown. The term Alaska Native refers to those in the first three groups collectively. Northern Canada provides data for the following groups: Inuit, First Nations, Metis and non-Aboriginal. The term Aboriginal is used to refer to those in the first three groups collectively. Greenland, Iceland, Norway and Finland did not provide race data as this information is not

collected in these countries.

In Northern Canada in 2000, Aboriginals comprised 56% of the population and represented 94% of the reported cases of invasive pneumococcal disease. In the U.S. Arctic (Alaska) in 2000, Natives made up 17% of the population and represented 47% of the reported cases of invasive pneumococcal disease. Rates of invasive pneumococcal disease in the Aboriginal and Alaska Native population are elevated at 40 and 55 cases per 100,000 population respectively and are higher in Natives/Aboriginals vs. non-Natives /non-Aboriginals ($p < .001$, $p = .02$ respectively). No commentary on race for *Neisseria meningitidis,* and the Group A and B streptococci will be made due to the low number of cases.

S pneumoniae

Table 10: Rates of invasive pneumococcal disease by race reported* to ICS, 2000

Northern Canada Total population = 133,375				**U.S. Arctic (Alaska)** Total population = 626,932			
Group	**Population**	**# *Sp* isolates**	**Rate per 100,000**	**Group**	**Population**	**# *Sp* isolates**	**Rate per 100,000**
Inuit	39,042	22	56	**Eskimo**	56,083	45	80
First Nations	29,616	8	27	**American Indian**	39,465	9	23
Métis	6,189	0	0	**Mixed Native Race**	Unk	3	Unk
				Aleut	12,697	2	16
Subtotal: Aboriginals	74,847	30	40	**Subtotal: Alaska Natives**	108,245	59	55
Non-Aboriginal	58,528	10	17	**Non-Native**	518,687	55	11
Total†	133,375	45	34	**Total**	626,932	125	20

* Data from Greenland, Iceland, Norway and Finland contains no information on race or ethnicity.
† 5 case-patients from Northern Canada and 11 case-patients from Alaska were of unknown race.
In AK, the rate of 55 vs 11 in Natives vs Non-natives is statistically significant at $p<.001$
In Canada, the rate of 40 vs 17 in Aboriginals vs Non-aboriginals is statistically significant at $p=.02$

In the U.S. Arctic (Alaska) and Northern Canada, Hi case numbers are small; however, it should be noted that 100% of Hi cases in Northern Canada occurred in the Aboriginal population while 63% of Hi cases in the U.S. Arctic (Alaska) occurred in Native people. Of the 16 cases of invasive Hi disease in Alaska, 9 (56%) were Hib.

H influenza

Table 11: Rates of invasive Haemophilus disease by race reported* to ICS, 2000

Northern Canada Total population = 133,375				U.S. Arctic (Alaska) Total population = 626,932				
Group	**Population**	**# *Hi* isolates**	**Rate per 100,000**	**Group**	**Pop**	**# *Hi* isolates**	**# *Hib* isolates**	**Rate per 100,000**
Inuit	39,042	6	15	**Eskimo**	56,083	6	4	11Hi 7Hib
First Nations	29,616	1	3	**American Indian**	39,465	3	1	8Hi 2.5Hib
Métis	6,189	0	0	**Aleut**	12,697	1	1	8
Subtotal: Aboriginals	74,847	7	9	**Subtotal: Alaska Natives**	108,245	10	6	9Hi 6Hib
Non-Aboriginal	58,528	0	0	**Non-Native**	518,687	5	3	1Hi .6Hib
Total †	133,375	8††	6	**Total**	626,932	16‡	9	3Hi 1Hib

* Data from Greenland, Iceland, Norway and Finland contains no information on race or ethnicity.
† 1 case-patient from Northern Canada and 1 case-patient from Alaska were of unknown race.
†† All eight are non B serotypes, serotype A (4), serotype D (1), non-typeable (3)
‡ Nine (56%) are Hib. 6 of the 7 remaining Hi isolates were serotyped: serotype E (1), serotype F (2), non-typeable (3)
In AK, the rate of 6 vs .6 for Hib disease in Natives vs non-Natives is statistically significant p<.001 In Canada, the rate of 9 vs 0 for Hi disease in Aboriginals vs non-Aboriginals is statistically significant p< .001

N meningitidis

Table 12: Rates of invasive meningococcal disease by race reported* to ICS, 2000

Northern Canada Total population = 133,375				U.S. Arctic (Alaska) Total population = 626,932			
Group	**Population**	**# *Nm* isolates**	**Rate per 100,000**	**Group**	**Population**	**# *Nm* isolates**	**Rate per 100,000**
Inuit	39,042	1	3	**Eskimo**	56,083	2	4
First Nations	29,616	0	0	**American Indian**	39,465	1	3
Métis	6,189	0	0	**Aleut**	12,697	0	0
Subtotal: Aboriginals	74,847	1	1	**Subtotal: Alaska Natives**	108,245	3	3
Non-Aboriginal	58,528	0	0	**Non-Native**	518,687	6	1
Total	133,375	1†	1	**Total**	626,932	9‡	1

*Data from Greenland, Iceland, Norway and Finland contains no information on race or ethnicity.
†Serogroup B
‡Serogroup B (7), serogroup Y (1), non-groupable (1)

Group A Strep

Table 13: Rates of invasive GAS by race reported* to ICS, 2000

Northern Canada Total population =133,375				U.S. Arctic (Alaska) Total population = 626,932			
Group	**Population**	**# *GAS* isolates**	**Rate per 100,000**	**Group**	**Population**	**# *GAS* isolates**	**Rate per 100,000**
Inuit	39,042	4	10	**Eskimo**	56,083	7	12
First Nations	29,616	3	10	**American Indian**	39,465	2	5
Métis	6,189	0	0	**Aleut**	12,697	1	8
Subtotal: Aboriginals	74,847	7	9	**Subtotal: Alaska Natives**	108,245	10	9
Non-Aboriginal	58,528	0	0	**Non-Native**	518,687	8	2
Total	133,375	7 †	5	**Total**	626,932	18	3

*Data from Greenland, Iceland, Norway and Finland contains no information on race or ethnicity
†6 of 7 isolates serotyped: serotype M3 (3), serotype M12 (1), serotype PT5 (1), non-typable (1)

Group B Strep

Table 14: Rates of invasive GBS by race reported* to ICS, 2000

Northern Canada Total population = 133,375				U.S. Arctic (Alaska) Total population = 626,932			
Group	**Population**	**# *GBS* isolates**	**Rate per 100,000**	**Group**	**Population**	**# *GBS* isolates**	**Rate per 100,000**
Inuit	39,042	1	3	**Eskimo**	56,083	1	2
First Nations	29,616	0	0	**American Indian**	39,465	0	0
Métis	6,189	0	0	**Aleut**	12,697	2	16
Subtotal: Aboriginals	74,847	1	1	**Subtotal: Alaska Natives**	108,245	3	3
Non-Aboriginal	58,528	3	5	**Non-Native**	518,687	13	3
Total	133,375	4†	3	**Total ‡**	626,932	18	3

* Data from Greenland, Iceland, Norway and Finland contains no information on race or ethnicity
†Serotype III (2), serotype V/R (1), serotype V (1)
‡2 case-patients from Alaska were of unknown race

F. Clinical Presentation

For invasive Sp, pneumonia and septicemia were the most common clinical presentations for the five countries that reported this information (Table 15). There was no invasive Hib disease reported in Northern Canada in 2000; however, in the U.S. Arctic (Alaska) the most common clinical presentations

for invasive Hib disease were pneumonia and meningitis. For invasive disease with Nm, the most common clinical presentations were meningitis and septicemia. For invasive disease with GBS, the most common clinical presentation was septicemia. GAS numbers were low.

Table 15: Clinical presentation of reported cases

	N CAN # (column %)						U.S. Arctic (Alaska) # (%)						GN # (%)	IC	NOR	FIN
	Sp	Hi	Hib	Nm	GAS	GBS	Sp	Hi	Hib	Nm	GAS	GBS	Sp	Sp	Sp	Sp
Pneumonia	29 (64)	0	0	0	3 (43)	0	68 (54)	9 (56)	5 (56)	0	2 (11)	2 (11)	3 (100)	3 (10)	393 (46)	NA
Septicemia	5 (11)	1 (13)	0	0	0	2 (50)	27 (22)	3 (19)	1 (11)	2 (22)	4 (22)	8 (44)	0	18 (62)	238 (28)	NA
Bacteremia	8 (18)	3 (38)	0	0	0	0	7 (6)	0	0	1 (11)	1 (6)	1 (6)	0	3 (10)	89 (10)	NA
Meningitis	3 (7)	2 (25)	0	1 (100)	0	0	11 (9)	3 (19)	2 (22)	5 (56)	0	1 (6)	0	3 (10)	82 (10)	NA
Empyema	0	1 (13)	0	0	0	0	4 (3)	0	0	0	1 (6)	0	0	0	0	NA
Cellulitis	0	0	0	0	2 (29)	0	1	0	0	0	4 (22)	4 (22)	0	0	0	NA
Necrotizing Fasciitis	0	0	0	0	1 (14)	0	0	0	0	0	0	0	0	0	0	NA
Septic Arthritis	0	0	0	0	1 (14)	2 (50)	2 (2)	1 (6)	0	0	2 (11)	0	0	2 (7)	8 (1)	NA
Other	0	1 (13)	0	0	0		5 (4)	0	0	0	4 (22)	2 (22)	0	0	47 (5)	NA
Total	45	8	0	1	7	4	125	16	9	9	18	18	3	29	857	601

G. Risk Factors

Information on medical conditions and risk factors for adult cases is summarized in Table 16. Fifteen-18% of persons with invasive pneumococcal disease, and 27-33% of persons with invasive Hi disease were likely to smoke cigarettes or have a chronic lung condition.

Table 16: Risk factors and medical conditions in adults from N. Canada, U.S. Arctic (Alaska), and Greenland combined

Medical Condition or Behavioral Factor	Adult cases from N CAN, AK, GN, & IC # (column %)				
	Sp All 4 countries	Hi AK & N Can	Nm AK & N Can	GAS AK & N Can	GBS AK & N Can
Cigarette Smoking	37 (18)	4 (27)	2 (20)	3 (12)	1 (5)
Chronic Lung Disease and, or Asthma	30 (15)	5 (33)	0	2 (8)	1 (5)
Alcohol Abuse*	24 (12)	2 (13)	1 (10)	6 (24)	3 (14)
Immunosuppressive Therapy	6 (3)	1 (6)	0	5 (20)	0
Diabetes Mellitus	15 (7)	1 (6)	1 (10)	1 (4)	3 (14)
Injection Drug User	2 (1)	0	0	1 (4)	0
Total number of cases	202	15	10	25	22

* If alcohol abuse is noted in the chart
No risk factor data from Norway or Finland

H. Vaccination Status (Sp, Hi (Hib), & Nm)

In the U.S. Arctic (Alaska), Northern Canada, Iceland, Norway, and Finland, 23 valent pneumococcal polysaccharide vaccine (PS23) is recommended for persons over 55 (AK), over 60 (Iceland) or over 65 years of age (N Canada, Norway and Finland), and to persons > 2 years of age with specific medical problems while the Hib conjugate vaccine is required as part of routine childhood vaccination in these countries. Table 17 shows vaccination status for cases reported into ICS. Vaccination status was missing from a high percentage of cases from all 3 countries. Ten to 16% of Sp cases were vaccinated with PS23 in the U.S. Arctic (Alaska) or Northern Canada; however, only 1% of Sp cases in Norway were vaccinated with PS23 indicating less frequent use of this vaccine in Norway.

Table 17: Case vaccination status for pneumococcal, Hib, and meningococcal vaccines

	Northern Canada			U.S. Arctic (Alaska)			Norway
	Sp	Hib	Nm	Sp	Hib	Nm	Sp
Total cases	45	8	1	125	9	9	857
Vaccinated* # (%)	7 (16%)	6 (75%)	0	12 (10%)	5 (44%)	0	10 (1%)
Vaccination status missing # (%)	6 (13%)	1 (13%)	1 (100%)	65 (52%)	2 (22%)	7 (78%)	397 (46%)

No vaccination data available from Greenland, Iceland, or Finland
* 23 valent pneumococcal polysaccharide vaccine, Hib conjugate vaccine, and quadrivalent meningococcal polysaccharide vaccine

I. Serotypes

S pneumoniae Serotypes

Serotypes 1 and 14 are the most prevalent in the North American Arctic. Due to lack of serotype data from other European countries, it is difficult to comment on serotype distribution in this region. Of the three most commonly reported serotypes from the U.S. Arctic (Alaska) (14, 4, and 7F) and Northern Canada (1, 9V, and 4), serotypes 7F and 1 are not included in the 7-valent conjugate vaccine. Serotypes common to (within the top 3 rankings of) two or more circumpolar arctic nations are the following: Serotype 4, 7F, 9V, and 14.

Table 18: *S pneumoniae* serotypes by country, ICS 2000

Serotype	N Canada		Alaska		Greenland		Iceland		Finland	
	# (%)	Rank	# (%)	Rank	# (%)	Rank	# (%)	Rank	# (%)	Rank
1	14 (31)	#1	5 (5)		1 (33)		0		6 (1)	
3	1 (2)		6 (5)		0		0		45 (9)	#2
4	4 (9)	#3	13 (12)	#2	1 (33)		1 (4)		73 (15)	#1
5	0		0		0		0		1 (.2)	
6A	2 (4)		4 (4)		0		2 (7)		18 (4)	
6B	2 (4)		4 (3)		0		3 (11)		36 (7)	
7F	2 (4)		10 (9)	#3	1 (33)		7 ((25) gr)	#1	40 (8)	#3
8	1 (2)		0		0		0		10 (2)	
9N	0		1 (1)		0		4 ((14) gr)	#2	12 (2)	
9V	5 (11)	#2	9 (8)		0		0		41 (8)	#3
10A	2 (4)		1 (1)		0		0		5 ((1) gr)	
11A	0		2 (2)		0		0		8 (2)	
12F	3 (7)		0		0		2 ((7) gr)		9 (2)	
13	0		1 (1)		0		0		1 (.2)	
14	4 (9)	#3	19 (17)	#1	0		3 (11)	#3	14 (3)	
15A	0		1 (1)		0		0		0	
15B	0		0		0		0		7 (1)	
15C	0		0		0		0		4 (1)	
16F	0		2 (2)		0		0		2 ((.4) gr)	
17F	0		1 (1)		0		0		3 ((.6) gr)	
18C	2 (4)		4 (4)		0		0		19 (4)	

19A	0	2 (2)	0	3 ((11) gr) #3	20 (4)
19F	1 (2)	7 (6)	0	0	30 (6)
20	0	1 (1)	0	0	5 (1)
22A	0	1 (1)	0	0	29 ((6) gr)
22F	0	5 (5)	0	0	0
23A	0	0	0	3 ((11) gr) #3	7 (1)
23F	2 (4)	3 (3)	0	0	34 (7)
24	0	0	0	0	1 (.2)
28	0	0	0	0	2 ((.4) gr)
33F	0	1 (1)	0	0	3 ((.6) gr)
35B	0	1 (1)	0	0	7 ((1) gr)
35F		1 (1)	0	0	0
Pool G	0	0	0	0	2 (.4)
38	0	1 (1)	0	0	2 (.4)
41	0	0	0	0	1 ((.2) gr)
46	0	0	0	0	1 (.2
Non-typable	0	0	0	0	0
Other*	0	4 (4)	0	0	0
Total	45 (100)	110 (88)	3 (100)	28 (97)	498 (83)

* Contaminated, non-viable or not received
(gr) indicates that organism was serogrouped and not serotyped
No serotype or serogroup data submitted by Norway

H influenza Serotypes

The most prevalent *H influenza* serotypes in the U.S. Arctic (Alaska) and Northern Canada are serotype B (Hib) and serotype A (Hia) respectively.

J. Vaccine-Preventable Cases and Deaths

S pneumoniae

For the five countries shown below (Table 19), > 80% of Sp cases in persons ≥ 2 years of age were preventable with use of the 23-valent polysaccharide vaccine. With use of the 7-valent conjugate vaccine, 49-100% of Sp cases in children < 2 years of age were potentially preventable. In Alaska, 62% of deaths due to invasive pneumococcal disease were potentially preventable with use of the 23-valent polysaccharide vaccine.

Table 19: Proportion of vaccine preventable cases/deaths from invasive pneumococcal disease, ICS 2000

	N Canada 2000 # (%)	Alaska 2000 # (%)	Greenland 2000 # (%)	Iceland 2000 # (%)	Finland 2000 # (%)
Cases ≥ 2 years old with serotype in the 23-valent pneumococcal polysaccharide vaccine	34 (100) Denom 34	67 (87) Denom 77	3 (100) Denom 3	23* (92) Denom 25	396* (83) Denom 479
Cases < 2 years old with serotype in the 7-valent pneumococcal conjugate vaccine	9 (82) Denom 11	24 (73) Denom 33	0 (No cases)	3† (100) Denom 3	26 (49) Denom 53
Deaths (all ages) for which the serotype was contained in the 23-valent pneumococcal vaccine	0 (No Sp deaths)	8 (62)	0 (No Sp deaths)	1 death (serotype 7)	N/A

Denominator is # of Sp isolates serotyped by country by age group

Iceland reported serogroup data and did not report any serotype data with the exception of 6A & 6B

Finland reported serogroup and serotype data. Serotyping was not performed on serogroups 10,16,17,22,28,33,35,41

*Assuming cross-reactivity among serotypes within a serogroup

ex. Icelandic case-patients with serotype 7 would be included as vaccine preventable cases despite the fact that the 23 valent vaccine contains 7F

†The 3 serogroups: 9,14,23

H influenza Group B (Hib)

In the U.S. Arctic (Alaska), 71% of Hib cases in persons < 2 years of age were preventable with the Hib conjugate vaccine while 33% of deaths in persons of all ages were preventable with this vaccine.

K. Outcome

Table 20: Age-specific *S pneumoniae* case-fatality ratios for N Can, AK, GN, IC & Nor combined ICS 2000.

	# Deaths	# Cases	Case-fatality ratio (CFR)
<2 yrs of age	2	88	.02
2-19	1	79	.01
20-39	4	139	.03
40-64	18	292	.06
≥ 65	59	461	.13
All Ages	84	1059	.08

Fatality data not available from Finland

Table 21: Age-specific Hi, Nm, GAS & GBS case-fatality ratios for N Can & AK combined, ICS 2000.

	Hi			Nm			GAS			GBS		
Age	**# Deaths**	**# Cases**	**CFR**	**# Deaths**	**# Cases**	**CFR**	**# Deaths**	**# Cases**	**CFR**	**# Deaths**	**# Cases**	**CFR**
<2 yrs	1	10	.10	0	2	0	2	4	.50	0	7	0
2-19	0	6	0	0	4	0	0	3	0	0	0	0
20-39	0	0	0	0	2	0	1	9	.11	0	2	0
40-64	2	5	.40	0	2	0	0	7	0	2	9	.22
≥ 65	1	3	.33	0	0	0	0	2	0	0	4	0
All Ages	4	24	.17	0	10	0	3	25	.12	2	22	.09

Hi, Nm, GAS & GBS data not yet reported by Greenland, Iceland, Norway or Finland

L. Antimicrobial Susceptibility

S pneumoniae

In Northern Canada, 9% of pneumococcal isolates recovered from patients with invasive disease were fully resistant to penicillin, and all those fully resistant to penicillin were serotype 9V (Table 22). In the US Arctic (Alaska), 13% were fully resistant to penicillin and comprised of serotypes 6B, 9V, 14, 19F. In addition, 28% and 21% were fully resistant to trimethoprimsulfamethoxizole and erythromycin respectively.

Table 22: Antibiotic susceptibility results for Sp isolates submitted from N CAN & AK to ICS, 2000.
S=sensitive I=intermediate resistance R=fully resistant

	Northern Canada				U.S. Arctic (Alaska)			
Antibiotic	**S**	**I**	**R**	**Tested**	**S**	**I**	**R**	**Tested**
Penicillin	41	0	4*	45	81	11	14 †	106
TMP-sulfa	41	0	4	45	72	4	30	106
Ceftriaxone	41	4	0	45	0	0	0	0
Erythromycin	44	1	0	45	84	0	22	106
Ofloxacin/Levoflox	44	1	0	45	106	0	0	106
Chloramphen.	45	0	0	45	104	0	2	106
Vancomycin	45	0	0	45	106	0	0	106
Clindamycin	37	0	0	37	35	0	1	36
Rifampin	8	0	0	8	103	0	0	103

Susceptibility data not available from Greenland, Iceland, Norway and Finland
* All Serotype 9V
† Serotype 14: 7 (50%)
Serotype 9V: 4 (29%)
Serotype 19F: 2 (14%)
Serotype 6B: 1 (7%)

M. Quality Control

Between January 1999 and July 2001, a total of 8 QC panels of 7 Sp isolates each were shipped and tested by all three reference laboratories in the U.S. Arctic (Alaska) and Canada. Serotyping correlation for 56 isolates was 96.9%. Discrepancies between serotyping results were attributed to loss of capsule following multiple passaging. Overall correlation of the MIC results within +/- one log2 dilution was 98.5%. Discrepancies in MIC's between laboratories could be explained by testing method (i.e., agar dilution vs broth dilution) and incubation conditions (i.e., with or without CO_2). Transportation times for QC panels between the participating laboratories were generally excellent (2-3 days).

Establishment of an international QC program for Sp is feasible and essential for the expansion of ICS to include laboratories in other Arctic States. International shipping of bacterial isolates requires strict adherence to transportation regulations and the maintenance of organism specific import permits. Both factors increase the cost of international QC programs and must be considered when planning future expansion of the initiative.

VI. CONCLUSIONS

The creation of the ICS program provides a framework for international cooperation in the surveillance of infectious diseases. The project to date has been successful in collecting *Streptococcus pneumoniae* data from six Arctic countries and has started compilation of other invasive bacterial disease cases in two of these states. Surveillance of these pathogens contributes to data regarding vaccine efficacy and provides an early-warning system for changes in antimicrobial resistance. A quality control program for *S. pneumoniae*

has been initiated between reference laboratories in the U.S. Arctic and Canada which provides a model for future QC programs with other countries in ICS. Continued improvement of the ICS program will add to the knowledge base from which disease control and prevention programs arise.

VII. ACKNOWLEDGMENTS

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We would like to thank all individuals involved in ICS at participating laboratories (local and reference), public health departments, and AIP (Table 29).

VIII. SOURCE

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IX. REFERENCES

Table 23: Participants in ICS 2000
Alaska, Northern Canada, Greenland, Iceland, Norway and Finland

Participants in International Circumpolar Surveillance (ICS) in 2000	
N O R T H E R N C A N A D A	
LCDC	▸Respiratory Division, Bureau of Infectious Diseases, Laboratory Centre for Disease Control, Ottawa, Canada
Reference Laboratories	▸National Centre for Streptococcus, Provincial Laboratory of Public Health, Edmonton, AB ▸Laboratoire de Santé Publique du Québec, Montréal, QC ▸National Centre for Meningococcus, Provincial Laboratory of Public Health, Winnipeg, MB
Yukon Territory	*Laboratory:* ▸Whitehorse General Hospital, Whitehorse, YK *Public Health:* ▸Yukon Communicable Disease Control, Whitehorse, YK
Northwest Territory	*Laboratories:* ▸Stanton Regional Health Board, Yellowknife, NT ▸H.H. Williams Memorial Hospital, Hay River, NT ▸Inuvik Regional Hospital, Inuvik, NT *Public Health:* ▸Health Protection Unit, Government of NWT, Yellowknife, NT
Nunavut	*Laboratories:* ▸Baffin Regional Hospital, Iqaluit, NU ▸Churchill Regional Health Authority, Churchill, MB ▸Cadham Provincial Laboratory, Winnipeg, MB *Public Health, and other:* ▸Health Protection Unit, Government of NWT, Yellowknife, NT ▸JA Hildes Northern Medical Unit, Winnipeg, MB

Participants in International Circumpolar Surveillance (ICS) in 2000	
Northern Québec	*Laboratories:* ▸Ungava Tulattavik Health Centre, Kuujjuaq, QC ▸Inulitsavik Hospital, Puvirnituq, QC ▸Cree Health Board, Chisasibi, QC ▸CSSSR, Chibougamou, QC ▸Val d'Or Hospital, Val d'Or, QC *Public Health:* ▸Régie Régionale de la Santé et des Services Sociaux (Nunavik), Kuujjuaq, QC ▸Région Cri de la Baie James, Module de Santé Publique, Montréal, QC
Labrador (north coast only)	*Laboratories:* ▸Melville Hospital, Goose Bay, Labrador ▸Newfoundland Public Health Laboratory, St. John's, NF *Public Health:* ▸Communicable Disease Control, Health Labrador Corporation, Goose Bay, Labrador
Others in Canada	▸IMPAct Coordinator, Vaccine Evaluation Centre, Vancouver, BC

Participants in International Circumpolar Surveillance (ICS) in 2000	
A L A S K A (U S A)	
Reference Laboratory	▸Arctic Investigations Program, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Anchorage, USA
Laboratories	▸Alaska Native Medical Center (ANMC), Anchorage, AK ▸Alaska Regional Hospital, Anchorage, AK ▸Bartlett Regional Hospital, Juneau, AK ▸Bassett Army Hospital, Fort Wainwright, AK ▸Central Peninsula General Hospital, Soldotna, AK ▸Cordova Community Medical Center, Cordova, AK ▸Elmendorf Air Force Base Hospital, Anchorage, AK ▸Fairbanks Memorial Hospital, Fairbanks, AK ▸Kanakanak Hospital, Dillingham, AK ▸Ketchikan Regional Hospital, Ketchikan, AK ▸Manilaq Medical Center, Kotzebue, AK ▸Norton Sound Regional Hospital, Nome, AK ▸Petersburg Medical Center, Petersburg, AK ▸Providence Alaska Medical Center, Anchorage, AK ▸Providence Island Medical Center, Kodiak, AK ▸QUEST Diagnostic Incorporated, Anchorage, AK ▸Samuel Simmonds Memorial Hospital, Barrow, AK ▸Sitka Community Hospital, Sitka, AK ▸South Peninsula Hospital, Homer, AK ▸Southeast Area Regional Health Corporation (SEARCH), Sitka, AK ▸State Public Health Laboratory, Division of Public Health, Department of Health and Social Services, Anchorage, AK ▸Valdez Community Hospital, Valdez, AK ▸Valley Hospital, Palmer, AK ▸Wrangell General Hospital, Wrangell, AK ▸Yukon-Kuskokwim Delta Regional Hospital, Bethel, AK

Participants in International Circumpolar Surveillance (ICS) in 2000	
GREENLAND	
Reference Laboratory	▸ Statens Serum Institute, Copenhagen, Denmark ▸ Centralab at Queen Ingrid´s Hospital, Nuuk
Laboratories	▸ Nanortalik Hospital ▸ Qaqortoq Hospital ▸ Narsaq Hospital ▸ Paamiut Hospital ▸ Maniitsoq Hospital ▸ Sisimiut Hospital ▸ Aasiaat Hospital ▸ Qasigiannguit Hospital ▸ Ilulissat Hospital ▸ Qeqertarsuaq Hospital ▸ Uummannaq Hospital ▸ Upernavik Hospital ▸ Qaanaaq Hospital ▸ Ammassalik Hospital ▸ Ittoqqortoormiit Hospital
ICELAND	
Reference Laboratory	▸ Department of Microbiology, Landspitali University Hospital, Reykjavik
Laboratories	▸ Isafjordur District Hospital ▸ Stykkisholmur Local Health Center ▸ St. Joseph's Hospital Hafnarfjorour ▸ Municipal Hospital of Vestmannaeyjar ▸ Akureyri ▸ Egilstadir Health Center ▸ Selfoss Health Center ▸ Sudurnes Health Center (Keflavik) ▸ Regional Hospital Neskaupstadur ▸ Akranes Hospital

Participants in International Circumpolar Surveillance (ICS) in 2000	
NORWAY	
Reference Laboratory	▸ **Oslo/Tromsø**
Laboratories	*Frederikstad, Østf. SSH* *Sarpsborg SH* *Akershus SSH, SiA* *Bærum SH* *Aker SH* *Fürsts laborat, Oslo* *Dr. Willes med.lab.* *Radiumhospitalet* *Folkehelsa, vir.lab.* *Folkehelsa, bakt.lab.* *Forsv.mik.lab.Folk.h.* *Rikshospitalet, mik.lab.* *Ullevål SH, mik.lab.* *Lab. klin. mikrob. Oslo* *Lillehammer mik.lab.* *Elverum mik.lab.* *Buskerud SSH, mik.lab.* *Vestfold SSh, mik.lab.* *Telelab* *Vest-Agder SSH, mik.lab.* *Rogaland SSH, mik.lab.* *Haukeland SH, mik.lab* *Sogn-Fk. SSH, mik.lab.* *Ålesund FSH, mik.lab.* *Molde FSH, mik.lab.* *Trondheim RSH, mik.lab.* *Innherred SH, mik.lab.* *Namdal SH, mik.lab.* *Nordland SSH, mik.lab.* *Tromsø RSH, mik.lab.* *Kirkenes SH, mik.lab.* *Laboratorium INA/div.* *Haugesund, mik.lab*

Participants in International Circumpolar Surveillance (ICS) in 2000	
FINLAND	
Reference Laboratory	▸ National Public Health Institute (KTL) laboratory, Oulu
Laboratories	Et.-Pohjanmaan sh-piiri, Seinäjoen sairaalan mikrobiol. lab. Etelä-Karjalan keskussairaalan kl.mikrobiologian laboratorio HY - Serobakteriologian laitos Jorvin sairaala, kliinisen mikrobiologian laboratorio KYS - Mikrobiologian laboratorio Kainuun keskussairaalan mikrobiologian laboratorio Kanta-Hämeen keskussairaalan mikrobiologian laboratorio Keski-Pohjanmaan keskussairaalan mikrobiologian laboratorio Keski-Suomen keskussairaalan mikrobiologian laboratorio Kymenlaakson keskussairaalan mikrobiologian laboratorio Lapin keskussairaalan mikrobiologian laboratorio Länsi-Pohjan keskussairaalan laboratorio Mikkelin keskussairaalan mikrobiologian laboratorio OYKS - Mikrobiologian laboratorio Oulun diakonissalaitoksen laboratoriot Pohjois-Karjalan keskussairaalan mikrobiologian laboratorio Päijät-Hämeen keskussairaalan mikrobiologian laboratorio Rauman aluesairaalan laboratorio Satakunnan keskussairaalan mikrobiologian laboratorio Savonlinnan keskussairaalan laboratorio TAYS - Mikrobiologian laboratorio TYKS - Mikrobiologian laboratorio Vaasan keskussairaalan mikrobiologian laboratorio